LIST OF CONTENTS

Number 1

SYMPOSIUM IN PRINT: BIOSEPARATION

J. Bridgwater	v	Editorial
WD. Deckwer	1	Editorial
M. V. Badiger, M. G. Kulkarni and R. A. Mashelkar	3	Concentration of macromolecules from aqueous solutions: a new swellex process
K. H. Bahr and K. Schügerl	11	Recovery of yeast from cultivation medium by continuous flotation and its dependence on cultivation conditions
SY. Huang and JD. Jin	21	Operation strategy for displacement chromatography: selection of optimum mobile phase for separation of weak adsorptive nucleotides
E. Vasheghani-Farahani,D. G. Cooper, J. H. Vera andM. E. Weber	31	Concentration of large biomolecules with hydrogels
J. B. Chaudhuri and D. L. Pyle	41	Emulsion liquid membrane extraction of organic acids—I. A theoretical model for lactic acid extraction with emulsion swelling
J. B. Chaudhuri and D. L. Pyle	49	Emulsion liquid membrane extraction of organic acids—II. Experimental
K. Rostami Jafarabad, S. B. Sawant, J. B. Joshi and S. K. Sikdar	57	Enzyme and protein mass transfer coefficient in aqueous two-phase systems—I. Spray extraction columns
K. Rostami Jafarabad, T. A. Patil, S. B. Sawant and J. B. Joshi	69	Enzyme and protein mass transfer coefficient in aqueous two-phase systems—II. York-Scheibel extraction column
N. J. Titchener-Hooker, M. Hoare, R. V. McIntosh and P. R. Foster	75	The effect of fluid-jet mixing on protein precipitate growth during low-frequency conditioning
L. C. Lievense, M. A. M. Verbeek, T. Taekema, G. Meerdink and K. van 't Riet	87	Modelling the inactivation of Lactobacillus plantarum during a drying process
G. A. Krei and H. Hustedt	99	Extraction of enzymes by reverse micelles
WH. Wang, R. Kuboi and I. Komasawa	113	Aqueous two-phase extraction of dehydrogenases using triazine dyes in PEG/phosphate systems
G. Vogels and MR. Kula	123	Combination of enzymatic and/or thermal pretreatment with mechanical cell disintegration
S. Asai, Y. Konishi and K. Yoshida	133	Kinetic model for batch bacterial dissolution of pyrite particles by <i>Thiobacillus ferrooxidans</i>
KG. Briefs and MR. Kula	141	Fast protein chromatography on analytical and prepara- tive scale using modified microporous membranes

iv	ist of Contents	
X. Hu, D. D. Do and Q. Yu	151	Effects of supporting and buffer electrolytes (NaCl, CH ₃ COOH and NH ₄ OH) on the diffusion of BSA in porous media
D. Forciniti, C. K. Hall and MR. Kula	165	Electrostatic effects on protein partitioning: simultaneous effect of pH and polymer molecular weight
S. Yamamoto and Y. Sano	177	Drying of enzymes: enzyme retention during drying of a single droplet
S. Yamamoto, M. Nomura and Y. Sano	185	Stepwise elution chromatography as a method for both purification and concentration of proteins
I. Bashir and M. Reuss	189	Dynamic model for cross-flow microfiltration of microbial suspensions in porous tubes
J. P. S. G. Crespo, A. M. R. B. Xavier, M. T. O. Barreto, L. M. D. Gonçalves, J. S. Almeida and M. J. T. Carrondo	205	Tangential flow filtration for continuous cell recycle culture of acidogenic bacteria
K. M. Clark and C. E. Glatz	215	A binding model for the precipitation of proteins by carboxymethyl cellulose
F. Bunge, M. Pietzsch, R. Müller and C. Syldatk	225	Mechanical disruption of Arthrobacter sp. DSM 3747 in stirred ball mills for the release of hydantoin-cleaving enzymes
A. Velayudhan and M. R. Ladisch	233	Effect of modulator sorption in gradient elution chromatography: gradient deformation
P. M. Boyer and J. T. Hsu	241	Effects of ligand concentration on protein adsorption in dye-ligand adsorbents
T. Gu, YH. Truei, GJ. Tsai and G. T. Tsao	253	Modeling of gradient elution in multicomponent non- linear chromatography
M. I. Rodrigues, C. A. Zaror, F. Maugeri and J. A. Asenjo	263	Dynamic modelling, simulation and control of continuous adsorption recycle extraction
R. M. McDonogh, H. Bauser, N. Stroh and H. Chmiel	271	Separation efficiency of membranes in biotechnology: an experimental and mathematical study of flux control

R. C. Senior and C. Brereton	281	Modelling of circulating fluidised-bed solids flow and distribution			
E. Hernández and Y. Arkun	297	Design of pole placement controllers for systems described by two-dimensional models			
G. Y. Chung, B. J. McCoy, J. M. Smith and D. E. Cagliostro	311	Chemical vapor infiltration: modelling solid matrix dep- sition for ceramic composites reinforced with layere woven fabrics			
RH. Jean, R. J. Eubanks, P. Jiang and LS. Fan	325	Fluidization behavior of polymeric particles in gas-solid fluidized beds			
D. C. Dankworth and S. Sundaresan	337	Time-dependent vertical gas-liquid flow in packed beds			

	•	List of Contents
D. T. Lynch	347	Chaotic behavior of reaction systems: parallel cubic auto- catalators
P. A. Olowson and A. E. Almstedt	357	Hydrodynamics of a bubbling fluidized bed: influence of pressure and fluidization velocity in terms of drag force
S. Rohani and B. Ng	367	Batch crystallization of KCl in the presence of soluble and insoluble impurities
P. Tontiwachwuthikul, A. Meisen and C. J. Lim	381	CO ₂ absorption by NaOH, monoethanolamine and 2-amino-2-methyl-1-propanol solutions in a packed column
P. G. Toledo, H. T. Davis and L. E. Scriven	391	Transport properties of anisotropic porous media: effective medium theory
B. Tabiś and A. Essekkat	407	Three-phase multi-compartment model for fluidized-bed catalytic reactors: autothermicity and multiplicity of steady states
M. Tassopoulos and D. E. Rosner	421	Simulation of vapor diffusion in anisotropic particulate deposits
E. G. Chatzi and C. Kiparissides	445	Dynamic simulation of bimodal drop size distributions in low-coalescence batch dispersion systems
C. Yao and C. Tien	457	Approximation of intraparticle mass transfer in adsorption processes—I. Linear systems
C. Yao and C. Tien	465	tion processes—II. Non-linear systems
B. Sudhakar	475	Shorter Communications An integral method for non-linear moving boundary problems
I. Tsibranska, I. Penchev and A. Assenov	479	The effect of microparticle-size distribution on the adsorption with biporous zeolite pellets
H. Merta and J. Zioło	483	New settling curves for the suspensions at higher initial concentrations
J. G. M. Winkelman, S. J. Brodsky and A. A. C. M. Beenackers	485	Effects of unequal diffusivities on enhancement factors for reversible reactions: numerical solutions and comparison with DeCoursey's method
S. T. L. Harrison and M. R. Mackley	490	A pulsatile flow bioreactor
N. C. Pradhan, A. Mehra and M. M. Sharma	493	Intensification and selectivity modification through the use of a microphase: simultaneous absorption of two gases with chemical reaction
E. Alpay and D. M. Scott	499	The linear driving force model for fast-cycle adsorption and desorption in spherical particle
S. Pushpavanam	502	The D-partition method: an application to the first-order irreversible exothermic reaction in a CSTR
G. Tosun	505	Letters to the Editors Comments on the transition between trickle flow and pulse flow in a cocurrent gas-liquid trickle-bed reactor at elevated pressures
W. J. A. Wammes, S. J. Mechielsen and K. R. Westerterp	506	Authors' reply to comments by G. Tosun

R. Aris	507	Comments on mitigation of backmixing via catalyst dilution
J. B. Joshi	508	Comments on flow mapping in bubble columns using CARPT
M. P. Duduković, N. Devanathan and D. Moslemian	509	Authors' reply to comments by J. B. Joshi
A. Lyddiatt	511	Book Reviews Chemical Engineering Problems in Biotechnology, Critical Reports on Applied Chemistry, Vol. 29. Edited by M. A. Winkler
WK. Yuan	512	Progress in Natural Science—Communication of State Key Laboratories of China
M. Sahimi	512	Dynamics of Fluids in Hierarchical Porous Media. Edited by J. H. Cushman
M. A. Winkler	513	Bioreaction Engineering, Vol. 2. By K. Schügerl
C. D. Grant	513	Chemical Engineering Vol. 1—Fluid Flow, Heat Transfer and Mass Transfer, 4th Edition. By J. M. Coulson, J. F. Richardson, J. R. Backhurst and J. H. Harker
R. M. Nedderman	514	Analytical Methods in Bin-load Analysis. By A. Drescher
	515	Corrigenda
		Number 3
B. J. Pangrle, E. G. Walsh, S. C. Moore and D. DiBiasio	517	Magnetic resonance imaging of laminar flow in porous tube and shell systems
P. K. Halder and P. Basu	527	Attrition of spherical electrode carbon particles during combustion in a turbulent fluidized bed
HJ. Warnecke, J. Prüss, B. Bienek and R. G. Presenti	533	Modeling isobutene extraction from mixed C ₄ -streams
G. M. Zhong, F. Meunier, S. Huberson and J. B. Chalfen	543	Pressurization of a single-component gas in an adsorption column
A. Wolny	551	Intensification of the evaporation process by electric field
W. Rommel, E. Blass and W. Meon	555	Plate separators for dispersed liquid-liquid systems: multi- phase flow, droplet coalescence, separation performance and design
A. N. S. Mak, P. J. Hamersma and J. M. H. Fortuin	565	Solids holdup and axial dispersion during countercurrent solids-liquid contacting in a pulsed packed column con- taining structured packing
P. Aimar and R. Field	579	Limiting flux in membrane separations: a model based on the viscosity dependency of the mass transfer coefficient
M. Otarod and J. Happel	587	Studies of the structure of chemical mechanisms
F. Stroh and V. Balakotaiah	593	Stability of uniform flow in packed-bed reactors
F. Özgülşen, R. A. Adomaitis and A. Çinar	605	A numerical method for determining optimal parameter

J. Ye and Q. Yuan 615 Optimal catalyst activity distribution for effectiveness factor, productivity and selectivity maximization in generalized nonisothermal reacting systems with arbitrary kinetics M. E. Garske and M. P. Harold 623 Observed kinetics of an exothermic reaction on a temperature-controlled catalytic wire D. B. Dadyburjor and Z. Liu 645 Coking in pulse and flow microreactors R. V. Shendye and Cracking of long chain n-paraffins on silica-alumina and R. A. Rajadhyaksha rare earth exchanged Y zeolite R. V. Shendye and Analysis of product selectivity in cracking of long chain R. A. Rajadhyaksha hydrocarbons by simulation of the molecular processes I. Nikov and H. Delmas Mechanism of liquid-solid mass transfer and shear stress in three-phase fluidized beds H. S. Kheshgi, S. F. Kistler 683 Rising and falling film flows: viewed from a first-order and L. E. Scriven approximation V. Mitlin and L. Bromberg 695 Analysis of diffusion through composite membranes—I. Mathematical development

Number 4

SYMPOSIUM IN PRINT: MODEL-BASED CONTROL

J. W. Eaton and J. B. Rawlings	705	Model-predictive control of chemical processes					
A. A. Patwardhan, G. T. Wright and T. F. Edgar	721	Nonlinear model-predictive control of distributed- parameter systems					
T. Peterson, E. Hernández, Y. Arkun and F. J. Schork	737	A nonlinear DMC algorithm and its application to a semibatch polymerization reactor					
J. D. Morningred, B. E. Paden, D. E. Seborg and D. A. Mellichamp	755	An adaptive nonlinear predictive controller					
N. F. Jerome and W. H. Ray	763	Model-predictive control of linear multivariable systems having time delays and right-half-plane zeros					
J. G. Balchen, D. Ljungquist and S. Strand	787	State-space predictive control					
W. Lu and D. G. Fisher	809	Nonminimal predictive control					
M. A. Henson and D. E. Seborg	821	Nonlinear control strategies for continuous fermenters					
P. Daoutidis and C. Kravaris	837	Dynamic output feedback control of minimum-phase nonlinear processes					
J. S. Logsdon and L. T. Biegler	851	Decomposition strategies for large-scale dynamic optimization problems					
J. H. Lee and M. Morari	865	Robust inferential control of multi-rate sampled-data systems					
E. Quintero-Marmol and W. L. Luyben	887	Inferential model-based control of multicomponent batch distillation					

- H. Schuler and C.-U. Schmidt

 899 Calorimetric-state estimators for chemical reactor diagnosis and control: review of methods and applications

 H.-T. Wu and B. Joseph

 917 A blackboard architecture for model-based reasoning and plan refinement in real-time process control

 D. J. Kozub and J. F. MacGregor

 929 Feedback control of polymer quality in semi-batch co-polymerization reactors

 S. H. Isaacs and M. Thoma

 943 The adaptive control of an airlift tower loop fermenter: an
 - acs and M. Thoma

 943 The adaptive control of an airlift tower loop fermenter: an application of model-based control employing a sophisticated process model

R. F.	959	Fischer-Tropsch synthesis gas conversion reactor					
R. Pal, Y. Yan and J. Masliyah	967	Rheology of clay-in-oil suspensions with added water droplets					
S. Kumar, R. Kumar and K. S. Gandhi	971	A multi-stage model for drop breakage in stirred vessels					
G. Bossis, A. Meunier and J. D. Sherwood	981	Numerical simulations of viscous resuspension					
Y. H. Khraisha and D. R. Dugwell	993	Coal combustion and limestone calcination in a suspension reactor					
P. Cicarelli and G. Astarita	1007	Micromixing and Shinnar paradoxes					
CC. Chen and CL. Chen	1017	Experimental study of bed-to-wall heat transfer in a circulating fluidized bed					
E. P. Vrahopoulou	1027	Flow distortions around particles between parallel wal with application to streak formation in slide-coatin methods					
W. Chen, S. Walker and J. C. Berg	1039	The mechanism of floc formation in protein precipitation by polyelectrolytes					
D. J. Kozub and J. F. MacGregor	1047	State estimation for semi-batch polymerization reactors					
S. Vajda and H. Rabitz	1063	Parametric sensitivity and self-similarity in thermal explosion theory					
A. B. Pandit, J. Varley, R. B. Thorpe and J. F. Davidson	1079	Measurement of bubble size distribution: an acoustic technique					
P. Daoutidis and C. Kravaris	1091	Structural evaluation of control configurations for multivariable nonlinear processes					
N. Abatzoglou, E. Chornet, K. Belkacemi and R. P. Overend	1109	9 Phenomenological kinetics of complex systems: the development of a generalized severity parameter and is application to lignocellulosics fractionation					
J. Xiao and J. Wei	1123	Diffusion mechanism of hydrocarbons in zeolites—I. Theory					
J. Xiao and J. Wei	1143	Diffusion mechanism of hydrocarbons in zeolites—II. Analysis of experimental observations					

E. Paolini, J. A. Romagnoli, A. C. Desages and A. Palazoglu	1161	Approximate models for control of nonlinear systems
O. E. Agamennoni, A. C. Desages and J. A. Romagnoli	1173	A multivariable delay compensator scheme
S. V. Sotirchos	1187	Steady-state versus transient measurement of effective diffusivities in porous media using the diffusion-cell method
L. K. Filippov	1199	Coherent and incoherent frontal patterns for multi- component dynamics of adsorption—I. Analysis of frontal-pattern isothermal adsorption dynamics for convex mixture isotherms of adsorption
L. K. Filippov	1211	Coherent and incoherent frontal patterns for multi- component adsorption dynamics—II. Non-uniqueness of frontal patterns in the isothermal case for convex isotherms of two-component mixtures
P. Labrune and A. Bergel	1219	Modelling of an indirect electrosynthesis process—I. Theoretical study of the effect of dismutation of the mediator
P. Labrune and A. Bergel	1229	Modelling of an indirect electrosynthesis process—II. Application to the reduction of methemoglobin
E. N. Rudisill and M. D. LeVan	1239	Standard states for the adsorbed-solution theory
J. M. Garr-Peters	1247	The neutral stability of surface-tension driven cavity flows subject to buoyant forces—I. Transverse and longitudinal disturbances
J. M. Garr-Peters	1265	The neutral stability of surface-tension driven cavity flows subject to buoyant forces—II. Oblique disturbances
J. Delgado and J. C. Liao	1277	Identifying constraints on bioreaction systems
V. A. Nikolov and A. I. Anastasov	1291	Influence of the inlet temperature on the performance of a fixed-bed reactor for oxidation of o -xylene into phthalic anhydride
S. Bridges and P. E. Barker	1299	Modelling continuous chromatographic separations
R. Banerjee, K. G. Narayankhedkar and S. P. Sukhatme	1307	Shorter Communications Exergy analysis of kinetic pressure swing adsorption processes: comparison of different cycle configurations
R. Gani and I. T. Cameron	1311	Modelling for dynamic simulation of chemical processes: the index problem
S. B. Jagtap, A. R. Pande and A. N. Gokarn	1315	Enhancement of coupled gas-solid reactions by iron catalysts
A. B. Jarzębski, A. I. Lachowski, J. Lorenc, J. Maślińska-Solich and W. Turek	1321	Effect of drying with supercritical carbon dioxide on enhancement and modification of polymeric catalysts' activity
XL. Yang, G. Wild and JP. Euzen	1323	A comparison of the hydrodynamics of packed-bed reactors with cocurrent upflow and downflow of gas and liquid
D. Vortmeyer, P. Wagner and E. Haidegger	1325	The interaction between temperature and flow in wall-cooled catalytic fixed-bed reactors

List of Contents X Letters to the Editors C. K. Svihla, D. Ridgway and 1329 Comments on determination of mass transfer coefficients T. R. Hanley in agitated gas-liquid reactors by instantaneous reaction 1330 Comments on chloride diffusion in a porous cylindrical W. N. Selander and J. H. Rowat concrete column 1331 Author's reply to comments by W. N. Selander and S. H. Lin J. H. Rowat Book Reviews 1333 DECHEMA Chemistry Data Series. Edited by D. Behrens H. Hofmann and R. Ekkermann. Heats of Mixing Data Collection. By J. Gmehling and T. Holderbaum. Vapour-Liquid Equilibrium Data Collection, Organic Hydroxy-compounds, Alcohols and Phenols. By J. Gmehling, U. Onken and J. R. Rarey. Phase Equilibria and Phase Diagrams of Electrolytes. By H. Engels R. Aris 1333 Chemical Oscillations and Instabilities. Non-linear Chemical Kinetics. By P. Gray and S. K. Scott 1335 Announcements Number 6

J. T. Tinge and A. A. H. Drinkenburg	1337	Absorption of gases into activated carbon-water slurries in a stirred cell				
Z. Zhang, M. A. Ferenczi and C. R. Thomas	1347	A micromanipulation technique with a theoretical ce model for determining mechanical properties of sing mammalian cells				
SY. Suen and M. R. Etzel	1355	A mathematical analysis of affinity membrane bio- separations				
S. Wang and A. Mersmann	1365	Initial-size-dependent growth rate dispersion of attrition fragments and secondary nuclei				
G. G. Chase and M. S. Willis	1373	Compressive cake filtration				
V. N. Burganos and A. C. Payatakes	1383	Knudsen diffusion in random and correlated networks of constricted pores				
D. I. Collias and R. K. Prud'homme	1401	Diagnostic techniques of mixing effectiveness: the effect of shear and elongation in drop production in mixing tanks				
C. N. Bowman and N. A. Peppas	1411	A kinetic gelation method for the simulation of free- radical polymerizations				
S. Lew, A. F. Sarofim and M. Flytzani-Stephanopoulos	1421	The reduction of zinc titanate and zinc oxide solids				
V. Bízek, J. Horáček, M. Koušová, A. Heyberger and J. Procházka	1433	Mathematical model of extraction of citric acid with amine				
F. Karavias and A. L. Myers	1441	Molecular thermodynamics of adsorption from gas				

metric data

mixtures: composition of adsorbed phase from gravi-

P. Grzybowski and L. Gradoń	1453	Analysis of motion and deposition of fibrous aerosol particles flowing around a single filter element: the electrotatic effect			
GJ. Tsai and G. T. Tsao	1461	Dynamic response of an isothermal three-phase slurry reactor—II. The PM-PM-HS/ID model: analytical solutions for two kinds of batch operation			
N. Jemaa, R. D. Noble and C. A. Koval	1469	Combined mass and energy balance analysis of an electro- chemically modulated equilibrium stage process			
J. Ježowski and F. Friedler	1481	A simple approach for maximum heat recovery calculations			
 J. R. González-Velasco, M. A. Gutiérrez-Ortiz, J. A. González-Marcos, N. Amadeo, M. A. Laborde and M. Paz 	1495	Optimal inlet temperature trajectories for adiabatic packed reactors with catalyst decay			
M. Giona	1503	First-order reaction-diffusion kinetics in complex fractal media			
R. J. Wijngaarden and K. R. Westerterp	1517	The role of pellet thermal stability in reactor design for heterogeneously catalysed chemical reactions			
	1523	Announcement			
		Number 7			
C. J. Guo, D. De Kee and B. Harrison	1525	Effect of molecular structure on diffusion of organic solvents in rubbers			
A. Irabien, F. Cortabitarte and M. I. Ortiz	1533	Kinetics of flue gas desulfurization at low temperatures: nonideal surface adsorption model			
M. G. Freiwald and W. R. Paterson	1545	Accuracy of model predictions and reliability of experimental data for heat transfer in packed beds			
J. T. F. Keurentjes, L. J. M. Linders, W. A. Beverloo and K. van 't Riet	1561	Membrane cascades for the separation of binary mixtures			
K. R. Matranga, A. L. Myers and E. D. Glandt	1569	Storage of natural gas by adsorption on activated carbon			
CC. Chen and MC. Wu	1581	A nucleation process for the separation of fine particles from flue gas			
S. H. Isaacs, H. Søeberg, L. H. Christensen and J. Villadsen	1591	A computational technique for simulating the dynamic response of a flow injection analysis system			
J. Landau	1601	Desorption with a chemical reaction			
M. G. Valix, D. L. Trimm, I. W. Smith and D. J. Harris	1607	Mass transfer effects in coal combustion			
U. Tüzün and P. Arteaga	1619	A microstructural model of flowing ternary mixtures of equal-density granules in hoppers			
M. J. Rhodes, X. S. Wang, H. Cheng, T. Hirama and B. M. Gibbs	1635	Similar profiles of solids flux in circulating fluidized-bed risers			

G. Carta, A. J. Mahajan, L. M. Cohen and C. H. Byers	1645	Chromatography of reversibly reacting mixtures: mutarotation effects in sugar separations
H. U. Onken and E. E. Wolf	1659	Self-sustained and forced oscillations during ethylene and carbon monoxide oxidation on $Pt-SiO_2$
D. A. Deshpande, M. D. Deo, F. V. Hanson and A. G. Oblad	1669	A model for the prediction of bubble size at a single orifice in two-phase gas-liquid systems
S. Whitaker	1677	The species mass jump condition at a singular surface
D. R. Acharya, R. Hughes, M. A. Kennard and Y. P. Liu	1687	Regeneration of fixed beds of coked chromia-alumina catalyst
M. J. Lampinen and I. Farkas	1695	Analysis of surface energy and pressure of liquid in porous materials
KY. Lee, LD. Liu and TJ. Liu	1703	Minimum wet thickness in extrusion slot coating
X. Hu and D. D. Do	1715	Multicomponent adsorption kinetics of hydrocarbons onto activated carbon: effect of adsorption equilibrium equations
N. Vatistas and P. F. Marconi	1727	The IEM mixing model in exothermic reactions
E. J. Molga and K. R. Westerterp	1733	Kinetics of the hydrogenation of 2,4-dinitrotoluene over a palladium on alumina catalyst
K. L. Levien	1751	Maximizing the product distribution in batch reactors: reactions in parallel
M. P. Hollewand and L. F. Gladden	1761	Modelling of diffusion and reaction in porous catalysts using a random three-dimensional network model
H. S. Kheshgi, S. C. Reyes, R. Hu and T. C. Ho	1771	Phase transition and steady-state multiplicity in a trickle- bed reactor
MY. Chang and B. I. Morsi	1779	Mass transfer in a three-phase reactor operating at elevated pressures and temperatures
	1791	Announcement
		N

V SIATH I. V. Dunckwerts Memorial Lecture	V	Sixth	Ρ.	V.	Danckwerts	Memorial	Lecture
---	---	-------	----	----	------------	----------	---------

S. Banerjee	1793	Sixth P. V. Danckwerts Memorial Lecture presented at Glaziers' Hall, London, U.K., 1 May 1991: Turbulence structures
K. Ohgaki, N. Hirokawa and M. Ueda	1819	Heterogeneity in aqueous solutions: electron microscopy of citric acid solutions
B. Young, D. Hildebrandt and D. Glasser	1825	Analysis of an exothermic reversible reaction in a catalytic reactor with periodic flow reversal
J. Baldyga and J. R. Bourne	1839	Interactions between mixing on various scales in stirred tank reactors
S. W. Horwatt, I. Manas-Zloczower and D. L. Feke	1849	Dispersion behavior of heterogeneous agglomerates at supercritical stresses

V. V. Ranade	1857	Flow in bubble columns: some numerical experiments
A. A. Potanin	1871	Macro- and microrheological modeling of spin coating
R. J. Wijngaarden and K. R. Westerterp	1881	Incorporation of statistical distributions of particle properties in chemical reactor design and operation: the cooled tubular reactor
R. YM. Lui and R. W. Thompson	1897	Analysis of a continuous crystallizer with agglomeration
P. Alvfors and G. Svedberg	1903	Modelling of the simultaneous calcination, sintering and sulphation of limestone and dolomite
J. A. M. Kuipers, K. J. van Duin, F. P. H. van Beckum and W. P. M. van Swaaij	1913	A numerical model of gas-fluidized beds
M. Rogalski, F. A. Mato and E. Neau	1925	Estimation of hydrocarbon critical properties from vapour pressure and liquid densities
G. Lapidus	1933	Mathematical modelling of metal leaching in nonporous minerals
A. A. Barresi and G. Baldi	1943	Deep catalytic oxidation kinetics of benzene- ethenylbenzene mixtures
M. A. Latifi, S. Rode, N. Midoux and A. Storck	1955	The use of microelectrodes for the determination of flow regimes in a trickle-bed reactor
J. T. F. Keurentjes, A. E. M. Janssen, A. P. Broek, A. van der Padt, J. A. Wesselingh and K. van 't Riet	1963	Multicomponent diffusion in dialysis membranes
F. Friedler, K. Tarján, Y. W. Huang and L. T. Fan	1973	Graph-theoretic approach to process synthesis: axioms and theorems
E. Goberdhansingh, L. Wang and W. R. Cluett	1989	Robust frequency domain identification
SC. Yen and JS. Wang	2001	Mass transfer and fluid flow due to a rotating disk with external forced convection
M. Barigou and M. Greaves	2009	Bubble-size distributions in a mechanically agitated gas-liquid contactor
R. J. Littel, G. F. Versteeg and W. P. M. van Swaaij	2027	Kinetics of CO ₂ with primary and secondary amines in aqueous solutions—I. Zwitterion deprotonation kinetics for DEA and DIPA in aqueous blends of alkanolamines
R. J. Littel, G. F. Versteeg and W. P. M. van Swaaij	2037	Kinetics of CO ₂ with primary and secondary amines in aqueous solutions—II. Influence of temperature on zwitterion formation and deprotonation rates
JW. Chang and CC. Yu	2047	Failure conditions for inverse-based multivariable controllers: internal model control structure
SS. Jang, D. SH. Wong and SJ. Wong	2057	Optimal robust linear controller design for chemical processes using an extended regional mapping approach
A. A. Golovin	2069	Mass transfer under interfacial turbulence: kinetic regularities
B. Linnhoff and V. R. Dhole	2081	Shaftwork targets for low-temperature process design

2093	Shorter Communications Effect of equilibrium selectivity in a kinetically controlled PSA separation
2095	Liquid distribution in packed columns
2097	Pressure drop for laminar flow of viscoelastic fluids in static mixers
2100	On the use of the characteristic method to solve linear homogeneous second-order differential equations with constant matrix coefficients for multicomponent reacting systems
2102	Some comments on drop breakup in pulsed sieve-plate columns
2105	Structural characteristics of packed beds of low aspect ratio
2109	Relationships between surface diffusivity and pore diffusivity in batch adsorption: measurements of the diffusivities for n -hexane and n -decane in 5 Å molecular sieves
2113	Synthesis of reactive mass-exchange networks
2120	The effective buoyancy and drag on spheres in a water-fluidized bed
2125	Gas absorption and desorption with reversible instantaneous chemical reaction
2129	Book Reviews Plant Design for Safety: a User Friendly Approach. By T. Kletz
2129	Computational Methods for Process Simulation. By W. F. Ramirez
2130	Chemical Engineering. By J. M. Coulson, J. F. Richardson, J. R. Backhurst and J. H. Harker
2131	Corrigendum
	2095 2097 2100 2102 2105 2109 2113 2120 2125 2129 2130

Number 9-11

Special issue: ISCRE 12

xi Preface

xiii List of reviewers

G. Astarita and R. Ocone

Plenary papers
P1. Chemical reaction engineering of complex mixtures
P2. Chemical reaction engineering in today's industrial environment

G. F. Froment 2163 P3. Kinetics and reactor design in the thermal cracking for olefins production A. Varma and JP. Lebrat 2179 P4. Combustion synthesis of advanced materials K. R. Westerterp 2195 P5. Multifunctional reactors Session A: multiphase reactors Al. Gas lift reactors: hydrodynamics, mass transfer, and scale up J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham V. Tukac and J. Hanika 2221 A3. A method for evaluation of mass transfer coefficients in the different regions of air lift reactors V. Tukac, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger T. Daszkowski and G. Eigenberger T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayamakos, P. A. Galtier, P. H. Bigeard and S. Kauztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berroti WL. Xu, P. Ding and WK. Yuan D. Santilippo, F. Buonomo, G. Fisco, M. Lupieri and I. Miracco 2231 A19. Fluidized bed reactors for paraffins dehydrogenation of Limitace of the exist of paraffins dehydrogenation of Limitace of the skess in bubble driven multiphase flow systems A17. Rovero and A. Gianetto A18. The behavior of packed bed electrode reactor A18. The behavior of packed bed electrode reactor A29. Hallier behavior of packed bed electrode reactor A19. Fluidized bed reactors for paraffins dehydrogenation of finitized bed reactors for paraffins dehydrogenation of packed bed electrode reactor			
M. Ghirardini, G. Donati and F. Rivetti J. Grienberger and H. Hofmann J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham V. Tukač and J. Hanika 2227 A3. A method for evaluation of mass transfer coefficients in the different regions of air lift reactors V. Tukač and J. Hanika 2227 A4. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactor V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenek P. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupjeri and C. Fusco, M. Lupjeri and C. Session A: multiphase reactors A1. Cas lift reactors: Al- multiphase reactors A1. Cas lift reactors in the different regions of air lift reactors A2. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactors A5. Cold modelling studies of fluidised bed reactors A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transition regime A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transfer and chemical reaction in catalyst filled tubes A7. A reevaluation of fluid flow, heat transfer and chemical reaction in catalyst filled tubes A7. A reevaluation of fluid flow, heat transfer and chemical reaction in catalyst filled tubes A7. A reevaluation of fluid flow, heat transfer and chemical reaction in catalyst filled tubes A7. A reevaluation of fluid flow, heat transfer and chemical reaction in catalyst filled tubes A7. A reevaluation of fluid	G. F. Froment	2163	
M. Ghirardini, G. Donati and F. Rivetti J. Grienberger and H. Hofmann J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham V. Tukač and J. Hanika 2227 A3. A method for evaluation of mass transfer coefficients in the different regions of air lift reactors V. Tukač and J. Hanika 2227 A4. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactor V. Tukan, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck P. Wong, T. Pugsley and F. Bruton, G. Fusco, M. Lupjeri and G. Pipica and G. Servero and R. Santilippo, F. Buonome, G. Fusco, M. Lupjeri and G. Fusco, M. Lupjeri and G. Fusco, M. Lupjeri and G. Pipica and G. Fusco, M. Lupjeri and G. Pipica and G. Fusco, M. Lupjeri and G. Pipicia and	A. Varma and JP. Lebrat	2179	P4. Combustion synthesis of advanced materials
M. Ghirardini, G. Donati and F. Rivetti J. Grienberger and H. Hofmann J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham V. Tukač and J. Hanika 2221 A3. A method for evaluation of mass transfer coefficients in the different regions of air lift reactors V. Tukač and J. Hanika 2222 A4. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactor V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan D. Sanfilippo, F. Buonow, G. Fusco, M. Lupieri and G. Siember A. Libbert and G. Fusco, M. Lupieri and G. Fusco, M. Lupier	K. R. Westerterp	2195	P5. Multifunctional reactors
J. C. Merchuk, G. Osemberg, M. Siegel and M. Shacham V. Tukač and J. Hanika 2227 A4. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactor R. Di Felice, S. Rapagna, P. U. Foscolo and L. G. Gibilaro V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Glanetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck P. H. Seusco, M. Lupieri and D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and C. Fusco, M. Lupieri and A19. Fluidized bed reactors A223 A5. Cold modelling studies of fluidised bed reactors A5. Cold modelling studies of fluidised bed reactors A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transition regime and the slow-fast transition regime and complex gas-liquid reactions: transport limitations in the slow-fast transition of fluid flow, heat transfer and chemical reaction in catalyst filled tubes 2253 A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transfer and chemical reaction in catalyst fluids bed reactors A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transfer and chemical reaction in catalyst fluids bed reactors A6. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transfer and chemical reactions: data fluid tubes A7. A reevaluation of fluid flow, heat transfer and chemical reaction in catalyst fluid tubes A7. A nevaluation of fluid flow, heat transfer and chemical reaction in		2209	A1. Gas lift reactors: hydrodynamics, mass transfer, and
M. Siegel and M. Shacham V. Tukač and J. Hanika 2227 A4. Influence of catalyst particles orientation on the pressure drop and the liquid dispersion in the trickle bed reactor R. Di Felice, S. Rapagna, P. U. Foscolo and L. G. Gibilaro V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck N. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and 2231 A5. Cold modelling studies of fluidised bed reactors A45. Cold modelling studies of fluidised bed reactors A55. Cold modelling studies of fluidised bed reactors A66. Kinetic analysis of complex gas-liquid reactions: transport limitations in the slow-fast transition regime and complex gas-liquid reactions: transport limitations in the slow-fast transition regime and chemical reaction in catalyst filled tubes 2251 A68. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A69. Multiphase catalytic kinetics in a three phase recirculating reactor A10. Macromixing versus hydrodynamics in trickle flow columns 2263 A10. Macromixing versus hydrodynamics in trickle flow columns 2264 A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas-liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the axial voidage profile and flow structure in risers of circulating fluidized beds W-L. Xu, P. Ding and W-K. Yuan D. Sanfilipp	J. Grienberger and H. Hofmann	2215	A2. Investigations and modelling of bubble columns
pressure drop and the liquid dispersion in the trickle bed reactor R. Di Felice, S. Rapagna, P. U. Foscolo and L. G. Gibilaro V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck R. Wong, T. Pugsley and F. Berruti R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and G. Figs. Pagliodized bed reactors 2233 A5. Cold modelling studies of fluidised bed reactors A6. Kinetic analysis of complex gas—liquid reactions: transport limitations in the slow—fast transition regime and show—fast transition reg		2221	
P. U. Foscolo and L. G. Gibilaro V. Tufano, R. Andreozzi, V. Caprio, M. G. D'Amore and A. Insola T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Präss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and A Lib, Cappayannakos, P. Buonomo, G. Fusco, M. Lupieri and A 19. Fluidized bed reactors for paraffins dehydrogenation 2239 A6. Kinetic analysis of complex gas—liquid reactions: transport limitations in the slow—fast transition regime and A. Kinetic analysis of complex gas—liquid reactions: transport limitations in the slow—fast transition regime and A. Kinetic analysis of complex gas—liquid reactions: transport limitations in the slow—fast transition regime and chemical reaction in catalyst filled tubes A8. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A9. Multiphase catalytic kinetics in a three phase recirculating reactor A10. Macromixing versus hydrodynamics in trickle flow columns 2269 A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode 2281 A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer 2295 A16. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A16. Influence	V. Tukač and J. Hanika	2227	pressure drop and the liquid dispersion in the trickle bed
T. Daszkowski and G. Eigenberger P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck Transport limitations in the slow-fast transition regime transport limitations in the slow-fast transition regime and call with a slow-fast transition regime and chemical reaction in catalyst filled tubes A. A. C. M. Beenackers A. A. C. M. Beenackers A. B. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A. A. C. M. Beenackers A. A. C. M. Beas entrainment rate and gas hold-up in loop-venturi reactors A. J. M. Multiphase catalytic kinetics in a three phase recirculating reactor A. I. Pseudo-homogeneous approach to CFB reactor design A. Li. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A. J. Hydrodynamic effects in bench scale hydr		2233	A5. Cold modelling studies of fluidised bed reactors
Cal reaction in catalyst filled tubes P. H. M. R. Cramers, L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck P. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupleri and A. A. C. M. Beenackers A8. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A8. Influence of the gas density on the gas entrainment rate and gas hold-up in loop-venturi reactors A9. Multiphase catalytic kinetics in a three phase recirculating reactor A10. Macromixing versus hydrodynamics in trickle flow columns 2263 A10. Macromixing versus hydrodynamics in trickle flow columns 2265 A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas-liquid upflow mode 2281 A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A15. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas-liquid mass transfer in a gas induced stirred slurry reactor A16. Influence of the wakes in bubble driven multiphase flow systems A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds A18. The behavior of packed bed electrode reactor	V. Caprio, M. G. D'Amore	2239	
L. L. van Dierendonck and A. A. C. M. Beenackers S. Sicardi, F. Chiampo, L. Manna and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti R. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan Tate and gas hold-up in loop-venturi reactors A. M. Multiphase catalytic kinetics in a three phase recirculating reactor A. M. Multiphase catalytic kinetics in a three phase recirculating reactor A. M. Multiphase catalytic kinetics in a three phase recirculating reactor A. M. Multiphase catalytic kinetics in a three phase recirculating reactor A. I. Pseudo-homogeneous approach to CFB reactor design All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode All. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid	T. Daszkowski and G. Eigenberger	2245	
and R. Conti M. Crine, P. Marchot, B. Lekhlif and G. L'Homme 2263 A10. Macromixing versus hydrodynamics in trickle flow columns S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and 2263 A10. Macromixing versus hydrodynamics in trickle flow columns 2265 A10. Macromixing versus hydrodynamics in trickle flow columns 2267 A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas-liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A15. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas-liquid mass transfer in a gas induced stirred slurry reactor J. Schmidt, R. Nassar and A. Lübbert A16. Influence of the wakes in bubble driven multiphase flow systems A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds A18. The behavior of packed bed electrode reactor	L. L. van Dierendonck and	2251	
S. Pagliolico, M. Tiprigan, G. Rovero and A. Gianetto N. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and 2269 A11. Pseudo-homogeneous approach to CFB reactor design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas—liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A15. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas—liquid mass transfer in a gas induced stirred slurry reactor A16. Influence of the wakes in bubble driven multiphase flow systems A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds WL. Xu, P. Ding and WK. Yuan A18. The behavior of packed bed electrode reactor A19. Fluidized bed reactors for paraffins dehydrogenation		2257	
G. Rovero and A. Gianetto M. G. Papayannakos, P. A. Galtier, P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and design A12. Hydrodynamic effects in bench scale hydrotreaters operating in cocurrent gas-liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A14. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas-liquid mass transfer in a gas induced stirred slurry reactor A16. Influence of the wakes in bubble driven multiphase flow systems A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds A18. The behavior of packed bed electrode reactor		2263	
P. H. Bigeard and S. Kasztelan M. Lindert, B. Kochbeck, J. Prüss, HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and Doperating in cocurrent gas-liquid upflow mode A13. Scale-up of airlift-loop bioreactors based on modelling the oxygen mass transfer A15. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas-liquid mass transfer in a gas induced stirred slurry reactor A16. Influence of the wakes in bubble driven multiphase flow systems A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds A18. The behavior of packed bed electrode reactor A19. Fluidized bed reactors for paraffins dehydrogenation		2269	
HJ. Warnecke and D. C. Hempel C. Mathieu, E. Dietrich, H. Delmas and J. Jenck 2289 A15. Hydrogenation of adiponitrile catalyzed by Raney nickel: use of intrinsic kinetics to measure gas—liquid mass transfer in a gas induced stirred slurry reactor J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti 2301 A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds WL. Xu, P. Ding and WK. Yuan 2307 A18. The behavior of packed bed electrode reactor D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and		2275	
H. Delmas and J. Jenck nickel: use of intrinsic kinetics to measure gas-liquid mass transfer in a gas induced stirred slurry reactor J. Schmidt, R. Nassar and A. Lübbert R. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan 2301 A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds WL. Xu, P. Ding and WK. Yuan 2307 A18. The behavior of packed bed electrode reactor D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and A19. Fluidized bed reactors for paraffins dehydrogenation	HJ. Warnecke and	2281	
A. Lübbert R. Wong, T. Pugsley and F. Berruti WL. Xu, P. Ding and WK. Yuan D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and flow systems 2301 A17. Modelling the axial voidage profile and flow structure in risers of circulating fluidized beds A18. The behavior of packed bed electrode reactor A19. Fluidized bed reactors for paraffins dehydrogenation		2289	nickel: use of intrinsic kinetics to measure gas-liquid mass
F. Berruti ture in risers of circulating fluidized beds WL. Xu, P. Ding and WK. Yuan 2307 A18. The behavior of packed bed electrode reactor D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and 2313 A19. Fluidized bed reactors for paraffins dehydrogenation		2295	
D. Sanfilippo, F. Buonomo, G. Fusco, M. Lupieri and 2313 A19. Fluidized bed reactors for paraffins dehydrogenation	0. 0 .	2301	
G. Fusco, M. Lupieri and tion	WL. Xu, P. Ding and WK. Yuan	2307	A18. The behavior of packed bed electrode reactor
	G. Fusco, M. Lupieri and	2313	

M. P. Martin, C. Derouin, P. Turlier, M. Forissier, G. Wild and J. R. Bernard	2319	A20. Catalytic cracking in riser reactors: core-annulus and elbow effects
F. Larachi, A. Laurent, G. Wild and N. Midoux	2325	A21. Pressure effects on gas-liquid interfacial areas in cocurrent trickle-flow reactors
M. A. Latifi, S. Rode, N. Midoux and A. Storck	2331	A22. Hydrodynamic study of a trickle-bed reactor by means of microelectrodes: analysis of the probability densities
J. G. H. Borkink and K. R. Westerterp	2337	A23. Determination of effective heat transport co- efficients for wall-cooled packed beds
R. A. Holub, M. P. Duduković and P. A. Ramachandran	2343	A24. A phenomenological model of pressure drop, liquid holdup, and flow regime transition in gas-liquid trickle flow
E. Izumoto, H. Fukuda, Y. Nojima and E. Nakanishi	2351	Session B: bioreactor engineering B1. Feedforward/feedback control of interesterification of fats and oils using a microaqueous bioreactor
V. Schlüter and WD. Deckwer	2357	B2. Gas/liquid mass transfer in stirred vessels
B. Ruggeri, G. Sassi, A. Gianetto, V. Specchia and F. Bosco	2363	B3. Mass transfer and observed activity for entrapped biomass
A. B. van der Meer, A. A. C. M. Beenackers, R. Burghard, N. H. Mulder and J. J. Fok	2369	B4. Gas/liquid mass transfer in a four-phase stirred fermentor: effects of organic phase hold-up and surfactant concentration
A. A. Kamen, C. Chavarie, G. André and J. Archambault	2375	B5. Design parameters and performance of a surface baffled helical ribbon impeller bioreactor for the culture of shear sensitive cells
S. P. Forestell, B. J. Milne, N. Kalogerakis and L. A. Behie	2381	B6. A cellular automaton model for the growth of anchorage-dependent mammalian cells used in vaccine production
G. A. Lewandowski and B. C. Baltzis	2389	Session C: safety and environmental problems C1. Analysis of sequencing batch bioreactors in large- scale denitrifying applications
A. Pintar and J. Levec	2395	C2. Catalytic liquid-phase oxidation of refractory organics in waste water
E. Tronconi, P. Forzatti, J. P. Gomez Martin and S. Malloggi	2401	C3. Selective catalytic removal of NO_x : a mathematical model for design of catalyst and reactor
G. Mura and A. Lallai	2407	C4. On the kinetics of dry reaction between calcium oxide and gas hydrochloric acid
U. Ullah, S. P. Waldram,C. J. Bennett and T. Truex	2413	C5. Monolithic reactors: mass transfer measurements under reacting conditions
P. F. B. Hansen, K. Dam-Johansen, J. E. Johnsson and T. Hulgaard	2419	C6. Catalytic reduction of NO and N ₂ O on limestone during sulfur capture under fluidized bed combustion conditions
W. Lin, K. Svoboda and C. M. van den Bleek	2425	C7. Sulphur capture and its interactions with NO_x emissions in fluidized bed combustion of coal: general analytical model based on particle gas—solid reactions

M. Benali, Z. N. Mao, C. Guy and J. Chaouki	2431	C8. Heat treatment and incineration of divided solids in a cocurrent downwards gas-solid reactor
M. H. Côté, R. Mayer, C. Chavarie and J. Chaouki	2437	C9. Development of a lamellar flow biofilm reactor for waste water treatment
S. Marchal-Brassely, J. Villermaux, JL. Houzelot and JL. Barnay	2445	Session D: reactor modelling, scale-up and control D1. Optimal operation of a semi-batch reactor by self-adaptive models for temperature and feed-rate profiles
E. Tronconi, N. Ferlazzo,P. Forzatti, I. Pasquon,B. Casale and L. Marini	2451	D2. A mathematical model for the catalytic hydrogenolysis of carbohydrates
J. Werther	2457	D3. Scale-up modeling for fluidized bed reactors
L. Pellegrini, S. Albertoni and G. Biardi	2463	D4. The occurrence of chaos in a tubular reactor with axial diffusion
M. Giona	2469	D5. Functional reconstruction of oscillating reaction: prediction and control of chaotic kinetics
M. Dente, M. Rovaglio, G. Bozzano, A. Sogaro and A. Isimbaldi	2475	D6. Gas-liquid reactor in the synthesis of urea
L. Manna, S. Sicardi, G. Baldi, L. van Dierendonck, T. Smeets and A. Stankiewicz	2481	D7. Influence of the unsteady state operations on yield and selectivity of a three phase catalytic reactor
A. Rastogi, J. Fotopoulos,C. Georgakis andH. G. Stenger, Jr.	2487	D8. The identification of kinetic expressions and the evolutionary optimization of specialty chemical batch reactors using tendency models
J. J. Romanainen and T. Salmi	2493	D9. The effect of reaction kinetics, mass transfer and flow pattern on non-catalytic and homogeneously catalyzed gas-liquid reactions in bubble columns
P. Carabin and D. Berk	2499	D10. Analysis and modelling of the isothermal and non-isothermal shrinking core model with non-linear kinetics
R. J. Olsen, W. R. Williams, X. Song, L. D. Schmidt and R. Aris	2505	D11. Dynamics of homogeneous-heterogeneous reactors
P. Andrigo, A. Caimi, P. Cavalierid'Oro, A. Fait, L. Roberti,M. Tampieri and V. Tartari	2511	D12. Phenol-acetone process: cumene oxidation kinetics and industrial plant simulation
J. M. Zaldivar, C. Barcons, H. Hernandez, E. Molga and T. J. Snee	2517	D13. Modelling and optimization of semibatch toluene mononitration with mixed acid from performance and safety viewpoints
F. Zardi and D. Bonvin	2523	D14. Modeling, simulation and model validation for an axial-radial ammonia synthesis reactor
T. Kimura and T. Kojima	2529	D15. Numerical model for reactions in a jetting fluidized bed coal gasifier
J. M. Arandes and H. I. de Lasa	2535	D16. Simulation and multiplicity of steady states in fluidized FCCUs
P. C. Borman and K. R. Westerterp	2541	D17. An experimental study of the selective oxidation of ethene in a wall cooled tubular packed bed reactor

P. H. M. Vleeschhouwer, R. D. Garton and J. M. H. Fortuin	2547	D18. Analysis of limit cycles in an industrial oxo reactor
P. B. Sistu and B. W. Bequette	2553	D19. A comparison of nonlinear control techniques for continuous stirred tank reactors
R. Pohorecki, J. Baldyga, W. Moniuk, A. Krzysztoforski and Z. Wójcik	2559	D20. Liquid-phase oxidation of cyclohexane—modeling and industrial scale process simulation
C. M. S. G. Baptista, J. G. V. F. Sousa and J. A. A. M. Castro	2565	D21. Modelling multitubular catalytic reactors: the influence of shell side flow
R. Maciel Filho and A. Domingues	2571	D22. A multitubular reactor for obtention of acetaldehyde by oxidation of ethyl alcohol
A. Urretabizkaia, G. Arzamendi and J. M. Asua	2579	Session E: polymer and new material engineering E1. Modeling semicontinuous emulsion terpolymerization
R. G. Pigeon and A. Varma	2585	E2. Some chemical reaction engineering considerations in the synthesis of silicon nitride
M. Caracotsios	2591	E3. Theoretical modelling of Amoco's gas phase horizontal stirred bed reactor for the manufacturing of polypropylene resins
PA. Fleury, Th. Meyer and A. Renken	2597	E4. Solution polymerization of methyl-methacrylate at high conversion in a recycle tubular reactor
J. Meuldijk, C. J. G. van Strien, F. A. H. C. van Doormalen and D. Thoenes	2603	E5. A novel reactor for continuous emulsion polymerisation
G. Maschio, T. Bello and C. Scali	2609	E6. Optimization of batch polymerization reactors: modelling and experimental results for suspension polymerization of MethylMethAcrylate
M. Sheintuch, O. Vashitz and A. Wolffberg	2615	E7. Engineering applications of bioluminescence: modelling of mass transfer in a hollow fiber and in a chemostat
A. R. Giona, M. Giona and L. Marrelli	2623	Session F: chemical kinetics F1. Influence of pore-network topology on the reaction-diffusion kinetics in porous pellets
M. Dente, S. Pierucci, E. Ranzi and G. Bussani	2629	F2. New improvements in modeling kinetic schemes for hydrocarbons pyrolysis reactors
H. J. Panneman and A. A. C. M. Beenackers	2635	F3. Solvent effects in the liquid phase hydration of cyclo- hexene catalyzed by a macroporous strong acid ion ex- change resin
E. Pieri, D. Pinelli and F. Trifirò	2641	F4. Silica as catalyst for cyclohexanone ammoximation with molecular oxygen: a preliminary approach to the kinetic analysis
M. Bistolfi, G. Fornasari,M. Molinari, S. Palmery,M. Dente and E. Ranzi	2647	F5. Kinetic model for methane oxidative coupling reactors
F. Rigamonti	2653	F6. Decarboxylation of chloroformates: a safe process in standard equipment

L. Jin, Z. Ding and M. A. Abraham	2659	F7. Catalytic supercritical water oxidation of 1,4-dichlorobenzene
R. Dümpelmann and A. Baiker	2665	F8. Criteria for gradientless operation of internal recycle reactors
I. Portugal, J. Vital and L. S. Lobo	2671	F9. Resin acids isomerization: a kinetic study
M. Zhu, Q. Miao and S. J. Parulekar	2677	F10. Oxidative pyrolysis of methane and monochloro- methane to higher hydrocarbons with steam
R. C. Sane, T. T. Tsotsis, I. A. Webster and V. S. Ravi-Kumar	2683	F11. Studies of asphaltene diffusion and structure and their implications for resid upgrading
I. Hablot, J. Jenck, G. Casamatta and H. Delmas	2689	F12. Gas-liquid-liquid reaction using water soluble catalyst
S. Di Carlo and B. Janis	2695	F13. Composition and visbreakability of petroleum residues
V. O. Strots, Yu. Sh. Matros and G. A. Bunimovich	2701	F14. Periodically forced SO ₂ oxidation in CSTR
W. Zimmerman, D. Bukur and S. Ledakowicz	2707	F15. Kinetic model of Fischer-Tropsch synthesis selectivity in the slurry phase
F. P. Di Maio and P. G. Lignola	2713	F16. KING, a KInetic Network Generator
J. Wei and X. Zhao	2721	Session G: catalyst design G1. Metal deposition and deactivation of hydrodemetal- lation catalysts
Z. Liu, S. Griswold and D. B. Dadyburjor	2727	G2. Design of group III nitrides as novel catalysts for hydrodenitrogenation of model coal-liquid compounds
K. Sundmacher and U. Hoffmann	2733	G3. Importance of irreversible thermodynamics for liquid phase ion exchange catalysis: experimental verification for MTBE-synthesis
J. Hanika and K. Sporka	2739	G4. Catalyst particle shape and dimension effects on gas oil hydrodesulphurization
CS. Yao and HS. Weng	2745	G5. Liquid-phase oxidation of cyclohexanone to dibasic acids over supported cerium catalysts
C. McGreavy, J. S. Andrade Jr. and K. Rajagopal	2751	G6. Consistent evaluation of effective diffusion and reaction in pore networks
M. P. Hollewand and L. F. Gladden	2757	G7. Representation of porous catalysts using random pore networks
M. Kotter, HG. Lintz and T. Turek	2763	G8. Selective catalytic reduction of nitrogen oxide by use of the Ljungstroem air heater as reactor: a case study
D. G. Vlachos, L. D. Schmidt and R. Aris	2769	G9. Structure of small catalyst particles
T. Masuda, N. Murakami and K. Hashimoto	2775	G10. Intracrystalline diffusivities of coked HZSM-5 zeolite
A. Tolia, T. Wilke, M. J. Weaver and C. G. Takoudis	2781	G11. Real-time measurements of reaction intermediates and adsorbed species in heterogeneous catalytic reaction systems

R. Gutfraind and M. Sheintuch	2787	G12. Anomalous scaling of diffusion and reaction processes on fractal catalysts
S. Marengo, S. Martinengo and L. Zanderighi	2793	G13. Studies under transient conditions of CO hydrogenation over Rh catalysts using an automatized microreactor
Y. H. Sun and Y. W. Li	2799	G14. Expert system approach to the preparation of supported catalyst
M. Grzesik, J. Skrzypek and B. W. Wojciechowski	2805	G15. Modelling of intraparticle diffusion affected by the time-on-stream catalyst decay
P. Čapek and K. Klusáček	2811	G16. Dynamics of water-gas shift reaction system
F. López-Isunza and L. S. Kershenbaum	2817	G17. The role of reversible changes in catalyst activity in the observed multiple steady states during partial oxi- dation dynamics
A. W. Nienow, S. M. Drain, A. P. Boyes, R. Mann, A. M. El-Hamouz and K. J. Carpenter	2825	Session H: mixing in chemical reactors H1. A new pair of reactions to characterize imperfect macro-mixing and partial segregation in a stirred semi- batch reactor
A. A. Barresi, M. Pipino and G. Baldi	2831	H2. A three-stage micromixing model for very fast reactions in tubular reactors
E. L. Paul, H. Mahadevan, J. Foster, M. Kennedy and M. Midler	2837	H3. The effect of mixing on scaleup of a parallel reaction system
R. David, H. Muhr and J. Villermaux	2841	H4. The yield of a consecutive-competitive reaction in a double jet semi-batch reactor: comparison between experiments and a multizone mixing model
Z. M. Zhu, J. Hannon and A. Green	2847	H5. Use of high intensity gas-liquid mixers as reactors
R. O. Fox	2853	H6. Computation of turbulent reactive flows: first-principles macro/micromixing models using probability density function methods
Y. B. Yang, N. Devanathan and M. P. Duduković	2859	H7. Liquid backmixing in bubble columns
P. M. Armenante, YT. Huang and T. Li	2865	H8. Determination of the minimum agitation speed to attain the just dispersed state in solid-liquid and liquid-liquid reactors provided with multiple impellers
M. Velan and T. K. Ramanujam	2871	H9. Gas-liquid mass transfer in a down flow jet loop reactor
E. S. Gaddis and A. Vogelpohl	2877	H10. The impinging-stream reactor: a high performance loop reactor for mass transfer controlled chemical reactions
Y. A. Saleh-Alhamed, R. R. Hudgins and P. L. Silveston	2885	Session I: novel and extreme reactors II. Periodic operation studies on the partial oxidation of propylene to acrolein and acrylic acid
R. Paludetto, G. Paret and G. Donati	2891	I2. Multicomponent distillation with chemical reaction: mathematical model analysis

J. Řeháček, M. Kubíček and M. Marek	2897	I3. Modelling of a tubular catalytic reactor with flow reversal
T. T. Tsotsis, A. M. Champagnie,S. P. Vasileiadis, Z. D. Ziaka andR. G. Minet	2903	I4. Packed bed catalytic membrane reactors
R. M. Quinta Ferreira, M. M. Marques, M. F. Babo and A. E. Rodrigues	2909	15. Modelling of the methane steam reforming reactor with large-pore catalysts
M. Maja and P. Spinelli	2915	I6. A bipolar porous electrode with internal mass transfer for electrochemical reactors
S. Bismo, P. Duverneuil, L. Pibouleau, S. Domenech and J. P. Couderc	2921	I7. Modelling of a new parallel-flow CVD reactor for low pressure silicon deposition
T. N. Haynes, C. Georgakis and H. S. Caram	2927	I8. The application of reverse flow reactors to endother- mic reactions
P. S. Christensen and H. Livbjerg	2933	I9. A new model for gas diffusion electrodes: application to molten carbonate fuel cells
J. W. Veldsink, R. M. J. van Damme, G. F. Versteeg and W. P. M. van Swaaij	2939	IIO. A catalytically active membrane reactor for fast, exothermic, heterogeneously catalysed reactions
T. Nozaki, O. Yamazaki, K. Omata and K. Fujimoto	2945	II1. Selective oxidative coupling of methane with membrane reactor
E. McKenna and M. Stoukides	2951	I12. Modeling of HCN synthesis in a solid electrolyte fuel cell
K. Scott, C. Odouza and W. Hui	2957	I13. Pilot scale electrosynthesis of alkene oxides by direct and indirect oxidation in a sieve plate electrochemical reactor
M. Matsukata, H. Oh-hashi, T. Kojima, Y. Mitsuyoshi and K. Ueyama	2963	I14. Vertical progress of methane conversion in a d.c. plasma fluidized bed reactor
R. Frost, K. Mordaunt, SK. Yang, G. W. Neudeck and C. G. Takoudis	2969	I15. Fundamental studies on the selective epitaxial growth of silicon-based films
J. Bridgwater	2975	ISCRE meetings; the past and the future
J. M. H. Fortuin	2977	The Working Party on Chemical Reaction Engineering
J. Wei	2983	Quo vadis reaction engineering?
	2985	Author Index

D. K. R. Nambiar, R. Kumar, T. R. Das and K. S. Gandhi	2989	A new model for the breakage frequency of drops in turbulent stirred dispersions
P. J. Hanratty and M. P. Duduković	3003	Detection of flow maldistribution in trickle-bed reactors via tracers

J. Stichlmair, J. Schmidt and R. Proplesch	3015	Electroextraction: a novel separation technique
H. J. H. Brouwers	3023	A film model for heat and mass transfer with fog formation
S. R. Lustig, J. M. Caruthers and N. A. Peppas	3037	Continuum thermodynamics and transport theory for polymer-fluid mixtures
T. Watanabe, I. Kuribayashi, T. Honda and A. Kanzawa	3059	Deformation and solidification of a droplet on a cold substrate
M. R. Mackley and N. E. Sherman	3067	Cross-flow cake filtration mechanisms and kinetics
SH. Shen and CC. Yu	3085	Indirect feedforward control: multivariable systems
S. M. Cho and H. H. Lee	3099	Catalyst pellet with unsymmetrical shell-progressive deactivation
B. Mazzarotta	3105	Abrasion and breakage phenomena in agitated crystal suspensions
H. Bi, P. Jiang, RH. Jean and LS. Fan	3113	Coarse-particle effects in a multisolid circulating fluidized bed for catalytic reactions
R. J. Wijngaarden and K. R. Westerterp	3125	The statistical character of packed-bed heat transport properties
M. Grzesik	3131	Effects of simultaneous mass and energy transport in porous media on non-isothermal gas-solid chemical processes
M. Punčochář and J. Drahoš	3137	Shorter Communications A novel approach in classification of solid particles with respect to the quality of fluidization
P. Deligiannis and J. W. Cleaver	3142	The influence of critical bubble swarms on the rate of nucleation
S. Wachi and A. G. Jones	3145	Dynamic modelling of particle size distribution and degree of agglomeration during precipitation
N. Gabas and C. Laguérie	3148	Batch crystallization of D-xylose by programmed cooling or by programmed adding of ethanol
S. S. Elshishini, S. S. E. H. Elnashaie and S. Alzahrani	3152	Digital simulation of industrial fluid catalytic cracking units—III. Effect of hydrodynamics
RS. Li and QH. Liu	3156	Sustained oscillations in isothermal, heterogeneously catalyzed reactions with the simplest Langmuir-type kinetics
B. Sudhakar	3158	On integral iterative formulations in classical Stefan problems
M. Hartman, D. Trnka and V. Havlin	3162	A relationship to estimate the porosity in liquid-solid fluidized beds
G. Astarita	3167	Letters to the Editors Comments on gas absorption and desorption with reversible instantaneous chemical reaction
R. G. Holdich	3167	Buoyancy force in sedimenting and filtering systems
G. T. Rochelle	3169	Comments on absorption of SO ₂ into aqueous systems

W. Pasiuk-Bronikowska and K. J. Rudzinski
 J. M. Beér
 Modelling of Gas-fired Furnaces and Boilers and Other Industrial Heating Processes. By J. M. Rhine and R. J. Tucker
 M. Streat
 J. B. Moss
 Rate-controlled Separations. By P. C. Wankat
 Base Bleed. Edited by K. K. Kuo and J. N. Fleming
 Announcement

Number 13/14

Special issue: The First International Conference on Gas-Liquid and Gas-Liquid-Solid Reactor Engineering

ix Preface

xi List of reviewers

W. P. M. van Swaaij and G. F. Versteeg	3181	Keynote papers K1. Mass transfer accompanied with complex reversible chemical reactions in gas-liquid systems: an overview
A. Gianetto and V. Specchia	3197	K2. Trickle-bed reactors: state of art and perspectives
M. H. Siegel and C. W. Robinson	3215	K3. Applications of airlift gas-liquid-solid reactors in biotechnology
B. L. Tarmy and C. A. Coulaloglou	3231	K4. Alpha-omega and beyond: industrial view of gas/liquid/solid reactor development
J. A. Helwick, P. O. Dillon and M. J. McCready	3249	Session A: fluid, particle and bubble mechanics A1. Time varying behavior of cocurrent gas-liquid flows in packed beds
D. C. Dankworth and S. Sundaresan	3257	A2. Stability of periodic travelling waves in trickle beds
G. M. Evans, G. J. Jameson and B. W. Atkinson	3265	A3. Prediction of the bubble size generated by a plunging liquid jet bubble column
H. Tsuge, Y. Nakajima and K. Terasaka	3273	A4. Behavior of bubbles formed from a submerged orifice under high system pressure
M. J. Bly and R. M. Worden	3281	A5. The effects of solids density and void fraction on the bubble rise velocity in a liquid-solid fluidized bed
M. Sangalli, Th. Prokopiou, M. J. McCready and HC. Chang	3289	A6. Observed transitions in two-phase stratified gas-liquid flow
H. F. Svendsen, H. A. Jakobsen and R. Torvik	3297	A7. Local flow structures in internal loop and bubble column reactors
C. Webb, F. Que and P. R. Senior	3305	A8. Dynamic simulation of gas-liquid dispersion behaviour in a 2-D bubble column using a graphics minisupercomputer
J. Drahoš, J. Zahradník, M. Fialová and F. Bradka	3313	A9. Identification and modelling of liquid flow structures in bubble column reactors

		Session B: hydrodynamics and mixing
T. Miyahara, K. Ogawa,Y. Nagano, A. Hirade andT. Takahashi	3323	B1. Flow dynamics in low height packed column having large fractional void space
M. C. Cassanello, O. M. Martinez and A. L. Cukierman	3331	B2. Effect of the liquid axial dispersion on the behavior of fixed bed three phase reactors
M. P. G. Thijert, M. H. Oyevaar, W. J. Kuper and K. R. Westerterp	3339	B3. Residence time distribution of the gas phase in a mechanically agitated gas-liquid reactor
K. Tsuchiya and O. Nakanishi	3347	B4. Gas holdup behavior in a tall bubble column with perforated plate distributors
P. R. Thimmapuram, N. S. Rao and S. C. Saxena	3355	B5. Characterization of hydrodynamic regimes in a bubble column
J. Schmidt, R. Nassar and A. Lübbert	3363	B6. Local dispersion in the liquid phase of gas-liquid reactors
Y. Bando, M. Nishimura, H. Sota, S. Suzuki and N. Kawase	3371	B7. Flow characteristics of countercurrent bubble column with perforated draft tube
M. Immich and U. Onken	3379	B8. Prediction of minimum gas velocity in suspended bubble columns and airlift reactors
J. B. Snape, M. Fialova, J. Zahradnik and N. H. Thomas	3387	B9. Hydrodynamic studies in an external loop airlift reactor containing aqueous electrolyte and sugar solutions
C. D. Rielly, G. M. Evans, J. F. Davidson and K. J. Carpenter	3395	B10. Effect of vessel scaleup on the hydrodynamics of a self-aerating concave blade impeller
A. Soria and H. de Lasa	3403	B11. Kinematic waves and flow patterns in bubble columns and three-phase fluidized beds
A. Tsutsumi, T. Charinpanitkul and K. Yoshida	3411	B12. Prediction of solid concentration profiles in three- phase reactors by a wake shedding model
S. D. Kim, H. S. Kim and J. H. Han	3419	B13. Axial dispersion characteristics in three-phase fluidized beds
N. Hidaka, M. Onitani, T. Matsumoto and S. Morooka	3427	B14. Axial mixing and segregation of multicomponent coarse particles fluidized by concurrent gas-liquid flow
V. S. Thompson and R. M. Worden	3435	B15. The effect of tracer diffusion on liquid axial dispersion in a three phase fluidized bed bioreactor
B. Kochbeck, M. Lindert and D. C. Hempel	3443	B16. Hydrodynamics and local parameters in three-phase-flow in airlift-loop reactors of different scale
G. Vunjak-Novakovic, G. Jovanovic, Lj. Kundakovic and B. Obradovic	3451	B17. Flow regimes and liquid mixing in a draft tube gas-liquid-solid fluidized bed
B. V. Nitta and M. H. Morgan III	3459	B18. Particle circulation and liquid bypassing in three phase draft tubed spouted beds
M. Kwauk, X. Ma, F. Ouyang, Y. Wu, D. Weng and L. Cheng	3467	B19. Magnetofluidized G/L/S systems

M. M. Marchese, A. Uribe-Salas and J. A. Finch	3475	B20. Measurement of gas holdup in a three-phase concurrent downflow column
A. L. Marquez, F. Larachi, G. Wild and A. Laurent	3485	Session C: mass and heat transfer C1. Mass transfer characteristics of fixed beds with co- current upflow and downflow: a special reference to the effect of pressure
A. S. Lamine, M. T. C. Serrano and G. Wild	3493	C2. Hydrodynamics and heat transfer in packed bed with cocurrent upflow
D. H. Anderson, F. J. Krambeck and A. V. Sapre	3501	C3. Development of trickle-bed heat transfer correlation for flow measurement probe
G. Grund, A. Schumpe and WD. Deckwer	3509	C4. Gas-liquid mass transfer in a bubble column with organic liquids
J. C. Merchuk and S. Ben-Zvi (Yona)	3517	C5. A novel approach to the correlation of mass transfer rates in bubble columns with non-Newtonian liquids
F. L. Muller and J. F. Davidson	3525	C6. On the contribution of small bubbles to mass transfer in bubble columns containing highly viscous liquids
S. Goto and P. D. Gaspillo	3533	C7. The effect of static mixer on mass transfer in draft tube bubble column and in external loop column
MY. Chang and B. I. Morsi	3541	C8. Solubilities and mass transfer coefficients of carbon monoxide in a gas-inducing reactor operating with organic liquids under high pressures and temperatures
C. L. Briens, L. X. Huynh, J. F. Large, A. Catros, J. R. Bernard and M. A. Bergougnou	3549	C9. Hydrodynamics and gas-liquid mass transfer in a downward venturi-bubble column combination
P. H. M. R. Cramers, A. A. C. M. Beenackers and L. L. van Dierendonck	3557	C10. Hydrodynamics and mass transfer characteristics of a loop-venturi reactor with a downflow liquid jet ejector
K. K. Tan and R. B. Thorpe	3565	C11. Gas diffusion into viscous and non-Newtonian liquids
O. Nore, C. Briens, A. Margaritis and G. Wild	3573	C12. Hydrodynamics, gas-liquid mass transfer and par- ticle-liquid heat and mass transfer in a three-phase fluidized bed for biochemical process applications
D. G. Karamanev, T. Nagamune and I. Endo	3581	C13. Hydrodynamic and mass transfer study of a gas-liquid-solid draft tube spouted bed bioreactor
H. Vinke, P. J. Hamersma and J. M. H. Fortuin	3589	C14. The enhancement of the gas-absorption rate in agitated slurry reactors due to the adhesion of gas-adsorbing particles to gas bubbles
E. Dietrich, C. Mathieu, H. Delmas and J. Jenck	3597	C15. Raney-nickel catalyzed hydrogenations: gas-liquid mass transfer in gas-induced stirred slurry reactors
M. T. Ityokumbul	3605	C16. A mass transfer approach to flotation column design
R. C. Chen and LS. Fan	3615	Session D: measurement technique D1. Particle image velocimetry for characterizing the flow structure in three-dimensional gas-liquid-solid fluidized beds

K. A. Ellis, T. Z. Fahidy and M. D. Pritzker	3623	D2. Application of computer vision to bubble detection at a gas-evolving electrode
R. F. Mudde, R. A. Bakker and H. E. A. van den Akker	3631	D3. Noise analysis of transmitted light beams for determining bubble velocity and gas holdup profiles in a bubble column
JS. Chang and G. D. Harvel	3639	D4. Determination of gas-liquid bubble column instantaneous interfacial area and void fraction by a real-time neutron radiography method
J. G. Daly, S. A. Patel and D. B. Bukur	3647	D5. Measurement of gas holdups and Sauter mean bubble diameters in bubble column reactors by dynamic gas disengagement method
R. Nassar, J. Schmidt and A. Luebbert	3657	Session E: reactor modeling, dynamics, and control E1. A stochastic dispersion model in gas-liquid flow systems
E. Pérez-Cisneros, M. Sales and T. Viveros-García	3665	E2. An analysis of selectivity in complex gas-liquid reacting systems
DR. Wu and LC. Shi	3673	E3. Variable analysis and mathematical model of cyclohexane oxidation reactor system
M. Roustan, A. Liné and O. Wable	3681	E4. Modeling of vertical downward gas-liquid flow for the design of a new contactor
P. Oinas, I. Turunen and H. Haario	3689	E5. Experimental design with steady-state and dynamic models of multiphase reactors
W. D. Provine, M. T. Klein and C. G. Scouten	3697	E6. An initial reaction pathway analysis of direct coal liquefaction: experimental results
K. Kiared and A. Zoulalian	3705	E7. Study and modelling of catalytic sulfur dioxide oxidation in "verlifix" three phase reactor
P. R. Prasad and J. F. Davis	3713	E8. A framework for implementing on-line diagnostic advisory systems in continuous process operations
J. Metzinger, W. Hasokowati, R. R. Hudgins, P. L. Silveston and S. Gangwal	3723	Session F: biological, environmental, hydrocarbon processing and other applications F1. Application of a periodically operated trickle bed to sulfur removal from stack gas
A. P. Boyes, A. Chughtai, X. X. Lu, S. Raymahasay, S. Sarmento, M. W. Tilston and J. M. Winterbottom	3729	F2. The cocurrent downflow contactor (CDC) reactor: chemically enhanced mass transfer and reaction studies for slurry and fixed bed catalytic hydrogenation
T. Hano, M. Matsumoto, K. Kuribayashi and Y. Hatate	3737	F3. Biological nitrogen removal in a bubble column with a draught tube
K. Fujie, HY. Hu, Y. Ikeda and K. Urano	3745	F4. Gas-liquid oxygen transfer characteristics in an aerobic submerged biofilter for the wastewater treatment
S. J. Gerdemann and A. Landsberg	3753	F5. The gravity-pressurized reactor as a means to efficiently carry out metallurgically important reactions
P. de Jong and H. J. L. J. van der Linden	3761	F6. Design and operation of reactors in the dairy industry

S. Lee, M. R. Gogate and 3769 F7. A novel single-step dimethyl ether (DME) synthesis in C. J. Kulik a three-phase slurry reactor from CO-rich syngas S. S. Jayadeokar and 3777 F8. Absorption of isobutylene in aqueous ethanol and M. M. Sharma mixed alcohols: cation exchange resins as catalyst J. G. M. Winkelman, H. Sijbring, 3785 F9. Modeling and simulation of industrial formaldehyde A. A. C. M. Beenackers and E. T. de Vries F.-W. Chang, J.-M. Chen and 3793 F10. The ethynylation kinetics of formaldehyde in a J.-C. Guo three-phase slurry reactor T. Gürkan, A. Nufal and I. Eroğlu 3801 F11. Kinetics of the heterogeneous oxidation of ammonium sulfite E. D. Snijder, G. F. Versteeg and 3809 F12. Theoretical study on hydrogenation catalysts con-W. P. M. van Swaaij taining a metal hydride as additional hydrogen supply A. G. Jones, J. Hostomsky and Z. Li 3817 F13. On the effect of liquid mixing rate on primary crystal size during the gas-liquid precipitation of calcium carbonate 3825 Author Index

Number 15/16

C. Azzaro, P. Duverneuil and J. P. Couderc	3827	Thermal and kinetic modelling of low-pressure chemical vapour deposition hot-wall tubular reactors
E. Gogolides, H. H. Sawin and R. A. Brown	3839	Direct calculation of time-periodic states of continuum models of radio-frequency plasmas
J. Torres and S. Cervera-March	3857	Kinetics of the photoassisted catalytic oxidation of $Pb(II)$ in TiO_2 suspensions
J. Rajaiah, G. Andrews, E. Ruckenstein and R. K. Gupta	3863	Thermal conductivity of concentrated, sterically stabilized suspensions
J. M. Modak and H. C. Lim	3869	Optimal mode of operation of bioreactor for fermentation processes
V. Linek, J. Sinkule and P. Benes	3885	Critical assessment of the dynamic double-response method for measuring $k_L a$: experimental elimination of dispersion effects
Y. D. Chen and R. T. Yang	3895	Predicting binary Fickian diffusivities from pure- component Fickian diffusivities for surface diffusion
D. Haim, O. Lev, L. M. Pismen and M. Sheintuch	3907	Modelling spatiotemporal patterns in anodic nickel dissolution
K. Li and W. K. Teo	3915	Theoretical analysis of ternary gas mixture separation in an internally staged permeator
C. E. Megiris and J. H. E. Glezer	3925	Preparation of silicon dioxide films by low-pressure chemical vapor deposition on dense and porous alumina substrates
F. Deza, E. Busvelle and J. P. Gauthier	3935	Exponentially converging observers for distillation columns and internal stability of the dynamic output feedback

J. Baldyga and J. R. Bourne	3943	Some consequences for turbulent mixing of fine-scale intermittency
A. M. Spasic	3949	Mechanism of the secondary liquid-liquid droplet-film rupture on inclined plate
C. Kuncewicz	3959	Three-dimensional model of laminar liquid flow for paddle impellers and flat-blade turbines
P. Lorenzini, M. Pons and J. Villermaux	3969	Free-radical polymerization engineering—III. Modelling homogeneous polymerization of ethylene: mathematical model and new method for obtaining molecular-weight distribution
P. Lorenzini, M. Pons and J. Villermaux	3981	Free-radical polymerization engineering—IV. Modelling homogeneous polymerization of ethylene: determination of model parameters and final adjustment of kinetic coefficients
D. C. Koopman and H. H. Lee	3989	Second-order reversible reactions and diffusion in a slab-like medium—II. Further analysis and general results
I. Ziółkowska, M. Krajewska and D. Ziółkowski	3999	Relation between the bed structure and the apparent radial gas velocity profile at the bed outlet in tubular apparatus
D. Ziółkowski and J. Michalski	4007	Onset of fluidization of fines in an organized system within voids of packings formed of spherical elements
M. D. Shieh and C. Lee	4017	A more general structural model which includes the induction time for gas-solid reactions—I. Nonporous solids
J. Boss	4027	Mixing time of grain materials—I. Theoretical considerations
J. Boss	4033	Mixing time of grain materials—II. Experimental part
A. Kumar and V. S. Patwardhan	4039	Aqueous solutions of single electrolytes: thermodynamic properties at high temperature and concentration
M. Grzesik, J. Skrzypek and B. W. Wojciechowski	4049	Time-on-stream catalyst decay behaviour in a fixed-bed catalytic reactor under the influence of intraparticle diffusion: intraparticle diffusion affects only catalytic reactions
J. B. L. M. Campos and J. R. F. Guedes de Carvalho	4057	Drag force on the particles at the upstream end of a packed bed and the stability of the roof of bubbles in fluidised beds
J. B. L. M. Campos and J. R. F. Guedes de Carvalho	4063	A new experimental technique to study backmixing in packed bubble columns
J. Drahoš, F. Bradka and M. Punčochář	4069	Fractal behaviour of pressure fluctuations in a bubble column
S. J. Parulekar	4077	Analytical optimization of some single-cycle and repeated fed-batch fermentations
M. P. S. Ramani	4099	Mass transport mechanism on the high-pressure side in reverse osmosis: an analysis
K. Nandakumar and H. J. Weinitschke	4107	A bifurcation study of chemically driven convection in a porous medium

	Li	ist of Contents xxix
F. Teymour and W. H. Ray	4121	The dynamic behavior of continuous polymerization reactors—V. Experimental investigation of limit-cycle behavior for vinyl acetate polymerization
F. Teymour and W. H. Ray	4133	The dynamic behavior of continuous polymerization reactors—VI. Complex dynamics in full-scale reactors
I. Seikova, C. Gourdon and G. Casamatta	4141	Single-drop transport in a Kühni extraction column
M. Asif, N. Kalogerakis and L. A. Behie	4155	Hydrodynamics of liquid fluidized beds including the distributor region
D. Dochain, M. Perrier and B. E. Ydstie	4167	Asymptotic observers for stirred tank reactors
K. R. Westerterp, H. J. Janssen and H. J. van der Kwast	4179	The catalytic hydrogenation of 2,4-dinitrotoluene in a continuous stirred three-phase slurry reactor with an evaporating solvent
H. J. Janssen, H. J. Vos and K. R. Westerterp	4191	A mathematical model for multiple hydrogenation reactions in a continuous stirred three-phase slurry reactor with an evaporating solvent
M. A. Soliman	4209	Shorter Communications A spline collocation method for the solution of diffusion—convection problems with chemical reactions
O. J. Smith IV and A. W. Westerberg	4213	The optimal design of pressure swing adsorption systems—II
A. Kumar and V. S. Patwardhan	4217	A simplified ionic hydration model with one parameter for prediction of vapour pressures of aqueous electrolytes at elevated temperatures
J. H. Hills	4221	Book Review Bubble Column Reactors. By WD. Deckwer
	4223	- Allege State of the State of
		Number 17/18
J. Nielsen and J. Villadsen	4225	Review Article Number 35. Modelling of microbial kinetics
J. H. A. Kiel, W. Prins and W. P. M. van Swaaij	4271	

J. H. A. Kiel, W. Prins and W. P. M. van Swaaij	4271	Modelling of non-catalytic reactions in a gas-solid trickle flow reactor: dry, regenerative flue gas desulphurisation using a silica-supported copper oxide sorbent
D. K. Boadi and A. Marmur	4287	Equilibrium of a liquid in a rotating groove
R. B. Thorpe	4295	An experimental clue to the importance of dilation in determining the flow rate of a granular material from a hopper or bin
D. M. Ruthven	4305	Diffusion of oxygen and nitrogen in carbon molecular sieve
F. Camacho Rubio, Mª. P. Paez Dueñas, G. Blazquez Garcia and J. M. Garrido Martin	4309	Oxygen absorption in alkaline sodium dithionite solutions

A. N. Zagoruiko, Yu. Sh. Matros, V. Ravi Kumar and B. D. Kulkarni	4315	Reactor performance with periodic flow reversal for a multistep complex reaction
F. K. Wasden and A. E. Dukler	4323	An experimental study of mass transfer from a wall into a wavy falling film
H. Binous and B. J. McCoy	4333	Chromatographic reactions of three components: application to separations
D. E. Langberg and G. J. Jameson	4345	The coexistence of the froth and liquid phases in a flotation column
X. Dai and N. A. Warner	4357	An investigation into the slag clearing phenomenon
N. Yan, Y. Shi and Y. F. Su	4365	A mass transfer model for type I facilitated transport in liquid membranes
E. E. Musschenga, P. J. Hamersma and J. M. H. Fortuin	4373	Momentum, heat and mass transfer in turbulent pipe flow: the extended random surface renewal model
H. Liu, L. Zhang and N. A. Seaton	4393	Determination of the connectivity of porous solids from nitrogen sorption measurements—II. Generalisation
A. E. Rodrigues, A. M. D. Ramos, J. M. Loureiro, M. Diaz and Z. P. Lu	4405	Influence of adsorption-desorption kinetics on the per- formance of chromatographic processes using large-pore supports
P. A. Sadd, J. A. Lamb and R. Clift	4415	The effect of surfactants on heat and mass transfer to water drops in air
R. Gutfraind and M. Sheintuch	4425	Scaling approach to study diffusion and reaction processes on fractal catalysts
D. T. Lynch	4435	Chaotic behavior of reaction systems: mixed cubic and quadratic autocatalysis
V. Goetz and A. Marty	4445	A model for reversible solid-gas reactions submitted to temperature and pressure constraints: simulation of the rate of reaction in solid-gas reactor used as chemical heat pump
J. E. Seebergh and J. C. Berg	4455	Dynamic wetting in the low capillary number regime
R. W. Field	4465	Shorter Communications Influence of viscosity variations upon heat transfer: further observations on cooling and condensation
J. E. Seebergh and J. C. Berg	4468	A comparison of force and optical techniques for the measurement of dynamic contact angles
A. K. T. Chan and C. E. Chaffey	4471	Increased sedimentation rate and viscosity in suspensions of humidified glass beads
A. E. Cassano .	4475	Book Reviews Potential Applications of Concentrated Solar Photons
J. R. Bourne	4475	Advances in Chemical Engineering Volume 17. Edited by J. Wei, J. L. Anderson, K. B. Bischoff and J. H. Seinfeld
B. J. Whitaker	4476	State-selected and State-to-state Ion-Molecule Reaction Dynamics. Part 1. Experiment. Edited by CY. Ng and M. Baer

i Index to Vol. 47, 1992

Reproduced with the permission of Pergamon Press Inc., by University Microfilms Inc. Duplication or resale without permission is prohibited.

